The Surgical Treatment of Cysts of the Pancreas.

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Read in the Section on Surgery and Anatomy at the Thirty-Sixth Annual Meeting of the American Medical Association

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THE SURGICAL TREATMENT OF CYSTS OF THE PANCREAS.

Under the benign influence of aseptic surgery the domain of operative treatment of disease has been gradually but steadily expanding, so that, even at the present time, almost every organ of the body is within reach of surgical aid when it has become the seat of injury or disease. The sphere of the physician is constantly being narrowed by successive achievements of modern surgery, which have been and are still multiplying with wonderful rapidity. The useless and often pernicious administration of drugs for the cure of local affections must and will yield to rational local treatment. Aseptic surgery has created a new era in the diagnosis of disease. All the large cavities can now be opened and the organs examined with comparative immunity. In obscure cases, speculative diagnosis must give way to direct inspection and palpation.

Aseptic surgery has also revolutionized that most important branch of medical science—experimental physiology and pathology. The realization of the object of our experiment is no longer marred or entirely frustrated by septic inflammation. Recent experimental research has established many new facts in physiology and has laid the foundation for modern pathology. Organs and parts of organs which were heretofore regarded as essential to the proper performance of the functions of life have been successfully removed in animals without producing any immediate or remote effects, and the knowledge thus obtained has been applied in practice, with the result

of establishing, upon legitimate grounds, a number of the most brilliant and life-saving operations. The surgery of the brain, the lungs, the heart, the liver, the kidneys, the gastro-intestinal canal, is only in its infancy, and yet it has contributed largely towards relieving suffering and prolonging life, and at the same time, it has added lustre both to the science and the art of surgery. Abdominal surgery is equivalent to aseptic surgery, and as such it is regarded favorably by many in the light of a new specialty. Modern surgery has not only added precision to the diagnosis of obscure abdominal affections, but in many instances offers the only inducement for successful treatment. Surgical affections of the kidney, spleen, stomach, intestines, and the essential organs of procreation in the female, have for some time constituted a fertile soil for surgical labor, with a certain promise for a rich harvest in the future.

Of all abdominal organs, the pancreas has been least frequently subjected to surgical treatment. The anatomical location of the organ, and the obscurity of its affections, furnish a sufficiently satisfactory explanation for this statement. Situated high up in the abdominal cavity, and hidden behind such important organs as the stomach, omentum, and transverse colon, it is the least accessible of all abdominal organs, and on this account, its affections, wrapped in obscurity, have for the most part constituted objects for empirical medication. The relation of this gland to surrounding organs, and its great distance from the anterior wall of the abdomen, the only point of approach, necessarily offer serious obstacles to diagnosis and direct treatment. In a diagnostic point of view I may also refer to another great difficulty—our want of positive knowledge concerning the physiological functions performed by this gland in the process of digestion. As the symptomatology of all affections of the pancreas is always obscure, and a probable diagnosis can only be made in cases

where the gland has become considerably enlarged by disease, it is apparent that our present clinical knowledge is limited to diseases which increase the size of the organ to a sufficient extent to determine their existence by palpation. Primary malignant disease of the pancreas, when it has advanced to such an extent that its presence can be diagnosticated with certainty by physical signs, will have invaded the adjacent tissues to such a degree as to preclude the advisability of an operation, consequently the efforts of the surgeon, for the present at least, must be directed exclusively towards the recognition and treatment of benign affections of this gland. Clinical experience does not extend beyond an imperfect knowledge of cysts of the pancreas.

The pancreas, like other secretory organs, is prone to become the seat of cystic tumors, the result of obliteration or obstruction of the common duct, or one or more of its branches. Cysts originating in this manner are true retention cysts, containing the physiological secretion from the distal portion of the gland tissue, with perhaps accidental products, such as altered secretions, blood, and the products of inflammation.

In the preparation of this paper it has been my intention to present to you a full report of a case of retention cyst of the pancreas which has recently come under my observation, and, at the same time, bring before you in a compact form the clinical history of similar cases, which will serve as a basis for some general remarks "on the surgical treatment of cysts of the pancreas."

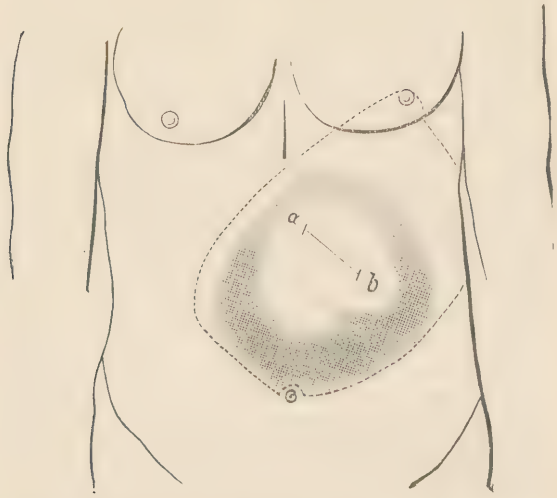
CYST OF PANCREAS; LAPAROTOMY; RECOVERY.

Volz, æt. 19, laborer, German, was admitted to Milwaukee Hospital, Nov. 28, 1884. He is small for his age and not robust, but he claims that with one exception, he has never been sick, and that no hereditary tendency to disease exists in his family. Five weeks

ago, while enjoying perfect health, he was thrown from a wagon striking the ground on the left side of the abdomen, a heavy keg falling upon his back and increasing the force of the fall. The pain felt immediately after the accident was confined to his back, at a point where he was struck by the keg, but it was not sufficient in intensity to prevent him from follow-lowing his occupation as a mason's apprentice. In a few days, however, diarrhœa set in, which persisted for two weeks, greatly reducing his strength and weight. If he had any fever during this time, it was not sufficiently severe to attract his attention. His appetite was not impaired, and, although he vomited occasionally, neither vomiting nor the diarrhœa seemed to be aggravated by the time of eating or the kind or variety of food. After two weeks he noticed a tumor in the left hypochondriac region which was round, smooth, and painless. The tumor increased rapidly in size, and soon gave rise to a sensation of fulness in the stomach, and later on to regurgitation and vomiting soon after meals. Appetite slightly impaired. At this time the patient was treated for a short time by my friend, Dr. F. H. Day, of Wauwatosa, Wis., who resorted to symptomatic treatment, and, observing no improvement, referred him to me for diagnosis, and, in case it should be deemed advisable, for surgical treatment. On his admission to the hospital he presented a considerable degree of emaciation, and complained principally of a sensation of fulness and weight in the region of the stomach, which was always aggravated after meals and only relieved by vomiting. On inspection a tumor was found, which occupied nearly the whole epigastric and the entire left hypochondriac region, its most prominent point being to the left of the median line, and about three inches below the xyphoid cartilage. Percussion revealed a line of dulness extending from the left nipple to within an inch above the umbilicus, posteriorly the dulness reached from the eighth to the lower

margin of the twelfth ribs, in the epigastric region a limited area of tympanitic resonance was discovered along the costal arch of the lower ribs on the right side. Palpation showed distinct fluctuation, the wave being conveyed from side to side across the whole area of dulness. The tumor was round in contour and presented a smooth surface. The measurements were as follows: From the left nipple to the lowest point downwards twenty-two centimetres, the transverse diameter twenty-one centimetres, and the anterior circumference sixty-three centimetres. The heart was pushed upwards so that the impulse of the apex could be distinctly felt in the fourth intercostal space. The stomach was artificially distended with carbonic acid gas, when it was ascertained that it was pushed to the right and compressed by the tumor. The liver appeared to be unaffected by the tumor, as on percussion it was found in its normal location and of natural size. Both lumbar regions were tympanitic. No evidences of ascites. Firm pressure over any part of the tumor could be made without causing pain. The peculiar fremitus often felt in cases of echinococcus cysts was absent. No pulsations could be felt in the tumor, and no impulse was imparted to it by the underlying abdominal aorta. The relative position of the tumor was changed during forcible inspiration and expiration. For the purpose of ascertaining the nature of the contents of the tumor a hypodermic needle was thoroughly disinfected and introduced at a point where the tumor was most prominent, and, when in place, the distal end of the syringe moved upward and downward synchronously with the respiratory movements, showing that the adhesions with the parietal peritoneum, if any existed, were slight. The fluid which was removed was somewhat viscid and slightly opalescent. It was alkaline in reaction and contained a considerable proportion of albumin, as it coagulated on applying heat and nitric acid. Under the microscope it showed only a

few morphological elements, epithelial cells, a few leucocytes, granular matter, and no hooklets or cholesterine crystals.



Space within dotted lines indicates area of dulness; *a–b*, line of incision.

By exclusion the diagnosis was narrowed down to one of two things: A sterile echinococcus cyst or cyst of the pancreas. Against the former spoke the rapid growth of the tumor, its primary origin away from the liver, its favorite location, the presence of considerable amount of albumin, and the absence of hooklets, the presence of which are diagnostic of echinococcus cysts. In favor of a pancreatic cyst spoke the following: The history of traumatism in the region of the pancreas, the rapid growth of the tumor, and the early disturbance of digestion as manifested by diarrhœa and vomiting, presumably

caused by the partial or complete retention of the pancreatic secretion. As the treatment remained the same in either case, it was decided to perform laparotomy and stitch the cyst walls to the peritoneal covering of the wound in the absence of adhesions, and to open and drain the cyst after adhesions had formed. This procedure was deemed preferable to the use of the trocar or aspirator as it would with certainty prevent extravasation of the cyst contents into the peritoneal cavity, and the drainage tube would guard against reaccumulation of the fluid, thus affording an opportunity of the cavity undergoing obliteration by adhesion of the inner surfaces of the cyst walls. The patient, being cognizant of the fact that no other form of treatment would promise any relief, readily assented to the operation proposed. Every precaution was observed to render the operation aseptic. The patient was given several baths, the parts were shaved and carefully disinfected with a five per cent. solution of carbolic acid, the instruments, sponges, and operating room being prepared the same as for an ovariotomy. Before ether was administered the stomach was emptied and washed out by means of an elastic stomach tube, with a view to prevent retching and vomiting during and after the operation. An incision five inches in length was made obliquely over the most prominent portion of the tumor, about three inches below and parallel with the left costal arch. A portion of the rectus abdominis muscle was divided. After dividing carefully all the tissues down to the peritoneum all hemorrhage was carefully and completely arrested.

On opening the peritoneal cavity, the omentum was brought into view, the portion exposed containing an artery and a vein of considerable size. As these vessels were placed in a vertical direction, they crossed the wound; and it became necessary to apply a double ligature, the omentum being then incised between them to the extent of about three inches.

The omentum was slightly adherent to the parietal peritoneum and the surface of the tumor. Through the omental incision the tumor could be distinctly seen and felt, presenting a smooth, whitish and glistening surface. As it had formed at least slight adhesions, it was decided to complete the operation. This plan was the more willingly adopted, as it was evident that the intra-cystic pressure was great, and the cyst walls thin—which would render stitching them to the margins of the wound difficult and unsafe. The surface of the tumor was then seized with two dissecting forceps about an inch apart, and gentle traction made during incision and evacuation of the cyst, so as to prevent all risk of extravasation of fluid into the peritoneal cavity. The peritoneal covering was picked up and nipped, and a grooved director was inserted into the opening made; owing to the thinness of the walls of the sac it penetrated the interior, and fluid escaped along the groove with considerable force. The opening was enlarged with the knife, when the fluid gushed forwards in jets and was caught in basins. The contents were removed as completely as possible by making external pressure and by placing the patient on the side. As the cyst was emptied its walls were drawn forward into the wound and stitched to the peritoneum, which had been previously united with the skin. The interior of the cyst was explored by inserting the index-finger, which passed directly backwards toward the tail of the pancreas. The bottom of the cavity could, however, not be reached. The inner surface of the cyst was smooth. Two large drainage tubes were inserted to the bottom of the cyst, and the remaining portion of the wound united in a similar manner as after ovariotomy, only that the rectus muscle was sutured separately. The fluid removed was estimated at three quarts, and presented the same appearance as that which was removed by exploratory puncture. The wound was dressed with a large antiseptic com-

press, which was retained *in situ* with an elastic rubber bandage. This bandage made of rubber webbing not only retains the dressing perfectly, allowing at the same time the movements of the chest and abdomen, but has an additional advantage, inasmuch as it exerts equable pressure, an important element in the after-treatment of all abdominal operations.

The patient never vomited during or after the operation, and experienced immediate relief on removing the pressure which was caused by the tumor. The pulse never rose over 90°, and the highest temperature observed was 100° F., the day after the operation. The appetite increased, and no unpleasant subjective symptoms were complained of at any time. On the third day the dressing showed moisture on the external surface, and it was changed. The gauze was saturated with the secretions from the cyst. The wound looked healthy, but the surrounding skin, as far as the dressing had extended, was red and macerated, and the epidermis could be removed in large flakes, leaving beneath a raw surface. The changes in the skin presented the same appearances as described by Kulenkampff and Gussenbauer, and claimed by them to be due to the digestive power of the pancreatic juice. The excoriated surface was sprinkled with salicylic acid, and was again covered with a Lister dressing. On account of profuse secretion from the cyst the dressings were changed every few days, and at every change the skin was found excoriated as far as it had been moistened by the secretion. At the end of the first week the sutures were removed and no further dressings were applied, whereupon the skin healed without suppuration, and only a minimum amount of pus escaped through the fistulous opening with the secretion. The secretion became clearer after the operation, and continued to discharge in varying quantities for almost four weeks. One of the drainage tubes inserted at the time of the operation was removed at the first change of the

dressing, and the second was gradually shortened, and entirely removed three weeks after the operation. At the end of the second week, the cyst was explored with a disinfected probe which passed to a depth of eight inches in the direction of the tail of the pancreas. The fistulous tract soon became live with granulations, and grew smaller in length and diameter so that at the end of eight weeks it was very narrow, so as to admit only a small probe, which could be passed only to a depth of four inches. The skin around the fistulous opening has been drawn inward, forming a deep funnel-shaped depression.

Jan. 22, 1885. Patient discharged cured. Fistula completely closed. Retraction of cicatrix very marked. General health good, digestion perfect. No swelling can be felt in the region of the pancreas.

Remarks.—The clinical history is somewhat similar to analogous cases which will be referred to in this paper. It was my intention to collect some of the secretion for the purpose of ascertaining its digestive properties on different articles of food, but before this could be done the amount secreted daily became so small that it was impossible to obtain corroborative diagnostic evidence from this source. The anatomical location of the tumor, its relations to the surrounding organs, its rapid growth, and the character of its contents, can leave no possible doubt that we had to deal with a genuine retention cyst of the pancreas. The question naturally arises, what was the cause of the obstruction? The history of the case points clearly to traumatism as the exciting cause. The patient had been in good health until he received the injury, and since that time he had not been well although he continued at his work for some time afterward. Whether the diarrhœa from which he suffered for the first two weeks resulted from injury to the pancreas, we are unable to prove, but it may be possible that a retention of the pancreatic secretion occurred after the traumatism, that diarrhœa may

have been produced by the absence of the fluid in the intestinal tract. As the patient at this time was not under medical observation, the character of the stools was not ascertained. As the injury was inflicted in the region of the pancreas, it is reasonable to assume that the pancreatic duct and the parenchyma of the gland were lacerated at a certain point, producing obstruction to the outflow of the secretion from the distal portion of the organ, the nature of the injury and the manner of obstruction being the same as in cases of rupture of the male urethra. It would be difficult to imagine that the common duct could be distended by the accumulation of the retained fluid to such an enormous extent in such a remarkably short time, hence we are forced to conclude that laceration of the duct took place, and that the pancreatic fluid infiltrated the gland, and the cyst formed at the expense of its parenchyma and by distension of the capsule of the organ. The cyst wall anteriorly was so thin that after cutting the peritoneal covering the grooved director penetrated directly into the interior of the cyst without using more than the slightest force, which would show that nothing but a little connective tissue was interposed between the peritoneum and the cyst-contents. The rapid growth of the cyst would indicate that the obstruction occurred at some distance from the caudal extremity of the gland, thus making a considerable portion of the secreting tissue contributory to the formation of the cyst. The early cessation of the discharge of the secretion through the abnormal outlet would tend to prove either that after the removal of the intra-cystic pressure the duct again became permeable, and thus furnished a free passage to the secretions into the intestinal canal through the natural channel, or that the gland tissue in the vicinity and distal to the cyst had been destroyed. In regard to the operation, it is necessary to say that I deviated from the usual plan in not making the incision through the linea alba.

The incision was made over the most prominent part of the tumor, for the following substantial reasons:

1. If adhesions had formed, they would naturally begin at a point where the tumor impinged most firmly against the anterior abdominal wall.

2. Incision over the most prominent portion of the cyst would afford the best point for effective drainage.

The band of connective tissue which would result from atrophy and obliteration of the cyst would form a permanent bridge between the cicatrix of the abdominal wound and the gland, consequently it is advisable to establish this necessary evil where it will do the least harm by interfering with the functions of important organs.

Aspiration of the cyst was not practised, because the exploratory puncture had demonstrated that firm adhesions had not taken place, and in the absence of these it was feared that some of the cyst contents might escape into the peritoneal cavity and produce peritonitis. The maceration of the skin was the result of the digestive action of the pancreatic juice, and this phenomenon furnished strongly corroborative diagnostic evidence in this as well as in previous cases.

The literature on the subject of cysts of the pancreas is extremely meagre, and after diligent search I have only been able to find an account of the following cases, of which I will give a brief report:

Case II.—Kulenkampff's case.[1] E., male, æt. 39, laborer, otherwise healthy, received a number of heavy blows on the abdomen on March 22, 1881. The blows were received, the patient believes, about the umbilicus and in the direction from below upwards. When examined a few hours later, no external signs of contusion could be seen, although he complained of intense pain in the upper abdominal and right

[1] Ein Fall von Pankreasfistel. Berliner Klinische Wochenschrift Feb. 13, 1882.

hypochondriac regions. Great tenderness on pressure. On the right side posteriorly, above the diaphragm, dulness over an area three inches in height. As the patient complained of lancinating pains in the same locality, and respiration was difficult, the attending physician was induced to diagnosticate traumatic pleurisy. In a few days the febrile symptoms and pain subsided, and in three weeks the patient seemed to be convalescent. Occasional attacks of pain in the hepatic and epigastric regions remained, and also tenderness on pressure. Physical examination at this time yielded only a negative result. Toward the latter part of May, a swelling made its appearance which seemed to take its origin from the liver. This swelling increased in size until September, when the following conditions were noted: In the epigastric region a round, dense, non-fluctuating tumor can be felt, of the size of a double fist. The larger part of the swelling is located on the right side of the mesial line. Its lower margin extends to within one and a half inches of the umbilicus. Percussion dulness continues with liver, giving the impression as though the tumor sprang from the left lobe of this organ. Tumor ascends and descends during the respiratory movements. Pulsation in an anterior direction. No bruit. Palpation unsatisfactory on account of the contraction of the recti muscles. Appetite and digestion not impaired. Temperature normal, no icterus. Examination of urine and stools furnished no clue to the diagnosis.

As from the existing signs and symptoms no diagnosis could be made, it was decided to render the tumor more accessible by dividing the tissues down to the peritoneum. On September 14, an incision was made through the linea alba down to the peritoneum. To the touch the tumor, which moved freely, imparted the sensation of a tense, nodular liver, as in cirrhosis of this organ. The trocar of an aspirator was now introduced towards the right of the mesial

line, and after penetrating through dense tissue the distance of a centimetre, a cavity was reached, from which about a quart of clear fluid was evacuated. The peritoneal cavity was not opened and the wound was packed with gauze, over which an antiseptic dressing was applied. The diagnosis of an echinococcus cyst, which had already been entertained, was strengthened by this examination. The fluid removed coagulated spontaneously on standing for some time, also on applying the tests for albumen. It contained no succinic acid. In the deposit, which was very scanty, blood and lymph corpuscles were discovered. On September 20 the peritoneum was incised and stitched to the skin. The finger which was introduced into the peritoneal cavity came in contact with a freely movable and nodular tumor which was supposed to be attached to the liver. Its size was fully as large as before the last operation. The incision was again filled with gauze, and four days later, adhesions having taken place, the tumor was incised, and about a quart of the same kind of fluid escaped through the wound. On digital exploration it was ascertained that the inner surface of the cyst was lined with mucous membrane, which was studded with polypoid growths. A large drainage tube was inserted and a Lister dressing applied. During the next two weeks there was no febrile reaction, the tumor disappeared, and large quantities of the same clear fluid escaped through the fistulous opening. On October 10 the secretion had diminished greatly, and the tract had been reduced to the size of an ordinary lead-pencil. Injections of iodine were made with a view to hasten the obliteration of the cyst, but this procedure excited pain, emesis, and renewed secretion of fluid, of which from one-fourth to three-fourths of a quart were evacuated during twenty-four hours. Cauterisation with nitrate of silver produced no better result. The skin remained in a state of maceration wherever it was moistened by the secre-

tion, in spite of often repeated changes of dressings. This peculiar condition of the skin first aroused the suspicion in Kulenkampff's mind that he was dealing with a fistula of the pancreas. He therefore collected some of the fluid and handed it to a chemist for analysis. The fluid was almost clear, colorless, frothing upon being shaken, slightly alkaline in reaction. It contained but few inorganic salts, and coagulated on applying heat and nitric acid. It contained no succinic acid. Experiments were made to ascertain its effects on coagulated albumen, neutral fats, and starch, the substances being kept at a temperature of 20–25° C. Special care was taken to preserve its alkaline reaction. A fresh paste made of four grms. wheaten flour and fifty grms. water was rendered very thin by the fluid. Fehling's solution showed the presence of 0.96 grms. glucose. Coagulated albumen of an egg, kept in a one-fourth per cent. solution of salicylic acid it showed no appreciable change. 0.195 grms. leucin and tyrosin were obtained from it. Three decigrammes freshly prepared lard were melted and subjected to the action of the fluid. A perfect emulsion was formed which had not given off free fat after the lapse of twelve hours. The chemical examination showed in 100 parts: 3.65 parts of albumen which coagulated on addition of alcohol and again was soluble in water; 8.57 parts of organic matter of various kinds; 8.09 parts of inorganic substances. Kulenkampff is inclined to the belief that the traumatism caused some parts of the pancreas to become inflamed, thus causing a constriction or obliteration in the duct of Wirsung or some of its branches. As long as the fistula continued to discharge the patient became emaciated, but there was no disturbance of digestion. The urine at no time contained sugar. It was noticed that the secretion was more profuse during the afternoon. The patient recovered completely after the closure of the fistula.

Remarks.—This case illustrates well the difficulties

which are met with in diagnosticating affections of the pancreas. Repeated examinations carefully made, direct exploration of the tumor at the time of the second operation, failed to throw sufficient light upon the case to enable the attending surgeon to make a positive diagnosis. The peculiar effect of the pancreatic juice upon the skin turned the attention of the operator in the right direction, and the chemical examination of the fluid, and the physiological tests to which it was subjected, finally resulted in a positive and correct conclusion.

In the next case, the operator asserts to have made a *probable* diagnosis before the operation.

Case III.—Gussenbauer's Case.[1] Male patient, musician, æt. 40, who has always been in good health and not affected by any hereditary taint, was taken suddenly ill after having, on a festive occasion, indulged too freely in the pleasures of the table. He complained of nausea, acute pain in the stomach, and, after having taken more alcoholic stimulants to relieve the symptoms, he vomited repeatedly. In a few days he recovered from this attack and remained well for two weeks, when he discovered a swelling in the region of the stomach, which increased rapidly in size, so that after two weeks it caused a visible bulging in the epigastric region. The appetite now became impaired, the patient complaining of a sensation of fulness after meals, accompanied by frequent eructations. During the next month he vomited after meals and became greatly emaciated. The treatment resorted to had no effect in arresting the rapid growth of the tumor, which soon became the source of radiating pains through the lumbar and sacral regions. When he was first seen by Gussenbauer, Dec. 21, 1882, about ten weeks after the illness had commenced, he was emaciated, skin pale and of a dirty grayish brown color. Respiration

[1] Zur operativen Behandlung der Pankreascysten. Archiv. f. Klin Chir., vol. xxix, p. 355.

thoracic, pulse full and regular. Percussion showed slight dulness in the right side (sternal region) from the third rib downward, complete dulness from the fifth rib. In the mammary line slight dulness at the upper margin of the fourth, complete dulness from fifth rib downward; in the axillary region, slight dulness over seventh, and complete dulness from eighth rib. On the left side slight dulness began at the upper margin of the third and extended to the eighth in the axillary line. Auscultation showed vesicular breathing on both sides of the chest. On examination of the abdomen, a prominent swelling attracted the attention, which extended over the right and left supraumbilical regions, and from the left costal arch into the right hypochondriac region. In the middle line the tumor measured 18½ centimetres from the xiphoid cartilage to two inches below the umbilicus; from the left costal cartilage to the right hypochondrium, 22 centimetres. Over the anterior surface of the tumor, as far as it was not covered by the left lobe of the liver, percussion elicited clear, full tympanitic resonance. If the abdominal wall was pressed against the tumor the percussion became dull. On inflating the stomach it could be seen rising above the tumor, its great curvature was easily mapped out by inspection and percussion. The transverse colon seemed to crop anteriorly over the middle of the tumor. It was movable only to a slight degree, and seemed to follow the respiratory movements. Tenderness on deep and firm pressure. No ascites. Bowels somewhat constipated, stools natural, with no admixture of fat. No abnormal constituents in urine. The rapid growth of the tumor and its location in the bursa omentalis behind the stomach and transverse colon, led Gussenbauer to make a probable diagnosis of a cyst of the pancreas or the suprarenal capsule.

As the patient was in a critical condition, and all other measures had failed to afford relief, the only

hope centred on a surgical operation, which was performed December 22, 1882. An incision was made in the linea alba about five inches in length, and the peritoneal cavity opened to the same extent. The stomach and great omentum were seen to cover the anterior surface of the tumor. The omentum was detached from the great curvature of the stomach for about three inches, several arteries were compressed temporarily and subsequently ligated. Through the omental incision the tumor came into view, covered by peritoneum. Fluctuation was now distinctly felt in the tumor. The upper and lower portions of the incision were closed, the parietal peritoneum was sutured to the external skin, and the anterior surface of the cyst to the margins of the wound. Through one of the punctures in the cyst wall a dark brown fluid escaped, and, as the suture was tied, the opening enlarged and the fluid escaped in a jet. A part of the contents of the cyst were evacuated by means of a trocar, in order to diminish the intracystic pressure and allow of a more perfect fixation of the cyst walls to the wound. When this had been done an incision three centimetres in length was made into the tumor, from which altogether 1,900 cubic centimetres of fluid escaped. Exploration of the interior of the cyst with the finger and sound indicated no traces of a solid tumor, but a smooth membrane lining the inner walls. The lower portion of the cyst walls were covered with black masses, which were easily detached and removed without giving rise to bleeding. The cavity was washed out with a solution of thymol, a large drainage tube introduced, and iodoform dressing applied. The fluid was of a grayish black color, and contained in suspension large quantities of masses of pigment, a few red corpuscles, in a state of degeneration, representing all forms of retrograde changes. The specific gravity of the fluid was 1.610, and its reaction alkaline. The dark color was due to the pigment, which was found

to be soluble in concentrated caustic soda and in acid alcohol. Spectrum analysis showed the presence of hæmatin, but not not of hæmoglobin. Further tests showed that it contained albumen, a body resembling mucin, and a material soluble in alcohol, but no bile pigment, metalbumen, peptones, or sugar. When the dressings were changed on the third day, the skin appeared to be macerated, which necessitated in the future a daily change of dressing. The patient was relieved promptly by the operation, and the wound healed without suppuration. After a few days the discharge from the fistula became clear, and on examination, it was found to contain leucin and tyrosin. Its reaction was alkaline, it digested albumen, and converted starch into sugar. Patient made a good recovery and was dismissed three weeks after the operation, with a small fistulous opening, which continued to discharge a small amount of pancreatic fluid. During the time he was kept under observation the fistula closed several times, and each time he suffered from a rise in temperature, which continued until the fistula opened and discharged again.

Remarks.—The origin of the cyst in this case was believed to be a hæmatoma of the pancreas. This assumption, however, lacks demonstation, and it is just as logical to assume that the cyst originated in the usual way from an obstruction, and that the blood in the cyst contents was an accidental product. The obstinacy of the fistula to close permanently would lead to the suspicion that the obstruction was of a permanent nature, either by the impaction of a calculus in the common duct, or obliteration of this channel by cicatricial contraction, the result of chronic inflammation.

The next three cases of cysts of the pancreas were mistaken for ovarian cysts, and the operation of ovariotomy was performed, when the nature of the cysts was discovered, in one instance during the operation, and in the remaining two at the necropsy.

Case IV.—Bozeman's Case.[1] The patient was a lady 41 years of age, and perfectly healthy up to seven years ago, with the exception of occasional attacks of indigestion. Seven years ago she experienced for the first time pain in the right iliac region, extending down the right thigh and at times attended with numbness. Five years ago the abdomen began to enlarge upon the left side, with a corresponding flatness upon the right side. The swelling increased slowly up to six weeks ago, when it suddenly began to grow rapidly. Finally, it filled symmetrically the entire abdominal cavity. At the same time the patient became emaciated and weak. Dr. T. G. Richardson, of New Orleans, who examined her at this time, diagnosticated the case as one of cystic tumor of one of the ovaries, and advised the patient to consult Dr. Bozeman. The patient entered the Woman's Hospital in New York, Nov. 19, 1881, where she came under Dr. Bozeman's care. The previous diagnosis was confirmed by Drs. Bozeman, Thomas, and Emmet. December 2 an operation was performed for the removal of the supposed ovarian cyst. Full antiseptic precautions were observed before and during the operation. When the tumor was reached through an incision below the umbilicus, its appearance was identical with that of an ordinary ovarian cyst, only that its color was of a more deep pearly hue. With a trocar two and one-half gallons of fluid were evacuated. After the fluid had nearly escaped about two-thirds of the cyst was drawn through the incision, and then for the first time the operators' suspicions were aroused that it was not ovarian. An exploration of the abdominal cavity revealed the presence of both ovaries in a healthy condition. The origin of the cyst was traced to the upper part of the abdomen. The incision was enlarged upwards two inches above the umbilicus. Further examination

[1] Removal of a cyst of the pancreas weighing 20½ pounds. Medical Record, Jan. 14, 1882.

showed that the stomach had been crowded against the diaphragm by the tumor, while the intestines were displaced in the opposite direction. The cyst was found adherent to the transverse mesocolon. In tracing the cyst walls still further the pancreas was reached, where a large vein was discovered which was very tortuous and subsequently identified as the splenic. As this vein was in close relationship to the pedicle, its presence rendered the operation more difficult. The tail of the pancreas lay in contact with the side of the cyst wall and firmly adherent to it to the extent of two inches. When this portion was separated the organ spread out and presented its natural appearance. The cyst sprang from the pancreas at the junction of the outer with the inner two-thirds, the pedicle being three-fourths of an inch in length and about the same in thickness. The veins of the pedicle were very large. The pedicle was transfixed and secured in a double ligature and cut off. On examination of the cyst it was discovered that a portion of it remained attached to the pedicle; this was subsequently completely removed by a careful dissection. The artery which supplied the cyst was as large as the brachial, and appeared to be a branch of the splenic. Very little bleeding attended the operation, and no ligatures were required. The fluid removed was of a light brownish color, acid reaction, and a specific gravity of 1.020. Tumor and contents weighed twenty and one-half pounds. Quinine, stimulants and opiates were given after the operation. The highest temperature, 101.5° F., was noted on the third day; the pulse never rose above 98. After omitting the quinine, the temperature rose to 102.8° F. on the eighth day, when quinine, in ten grain doses every six hours, reduced the temperature to nearly normal in the course of thirty-six hours. From this time the improvement continued uninterruptedly to the time when the patient was discharged cured, on the thirty-eighth day.

Case V.—K. von Rokitansky's case, reported by Zukowski.[1] The patient was a female, 36 years of age, who had suffered with symptoms indicative of ovarian cyst for nearly three years. The tumor was first noticed in the upper portion of the abdominal cavity. Laparotomy was performed Feb. 27, 1881. The usual incision was made in the linea alba, and the supposed ovarian cyst was found behind the great omentum, stomach, and transverse colon. The cyst wall adhered firmly to the surrounding organs, and on attempting to separate the adhesions between it and the transverse colon, a rent was made in the bowel two ctms. in length. The tear was at once closed with five sutures. The adhesions were so numerous, firm and vascular, that complete extirpation of the entire cyst was found impossible, consequently the detached portion of the cyst was crushed off with an ecraseur, and the stump fastened in the abdominal incision, and the wound drained and closed. During the operation the cyst ruptured and a portion of its contents escaped into the peritoneal cavity. Fifty ligatures were applied in preventing and securing hemorrhage. After the operation the patient collapsed and came nearly dying on the table. She rallied from the immediate effects of the operation but died on the tenth day from suppurative peritonitis. Sometime before death, fecal matter escaped through the opening left by the drainage tube. At the autopsy it was shown that the remaining portions of the cyst were connected with the pancreas. Of this organ only the head was found in a normal condition, of the body only a few remnants remained, while the tail had disappeared completely.

Case VI.—Luecke's Case, reported by Luecke and Klebs.[2] A female, 43 years old, with the excep-

[1]Grosse Cyste des Pankreas. Laparotomie. Tod. Wiener med. Presse. 1881, Nov. 15.

[2]Beitrag zur Ovariotomie und zur Kenntniss der Abdominalgeschwuelste. Virchow's Archiv. vol. xli, p. 9.

tion of bronchial catarrh had always been in good health. In July, 1866, at the time when menstruation should have appeared, she experienced a severe pain in the right hypochondriac region, where a swelling soon afterward made its appearance. The tumor gradually increased in size and soon occupied the entire abdominal cavity. During the menstrual period the swelling always became tender and painful. She was admitted to the hospital under Luecke's care, Nov. 29, of the same year, and then appeared pale and emaciated. She complained of difficulty in breathing, all other functions were unimpaired. The abdomen was symmetrically enlarged, its greatest circumference measured ninety-five ctms. The distance from the xiphoid cartilage to the umbilicus measured fourteen ctm., from the umbilicus to the pubes eighteen ctm. Percussion revealed dulness over middle of the abdomen as far as half way between the umbilicus and xiphoid cartilage. Lumbar regions tympanitic. An examination, per vaginam and rectum showed that the uterus was displaced backward and toward the left side; upon its posterior surface a hard nodule could be felt. Tumor appeared to have no connection with the uterus. On Dec. 1, menstruation set in with severe pain in the lower part of the abdomen. No change in temperature or pulse rate. Dec. 6, the tumor was tapped at a point to the left of the median line, and twenty-three pints of a turbid yellowish fluid were evacuated. After tapping, a movable tumor was felt in the left side of the abdominal cavity, which was regarded as the collapsed sac of the ovarian cyst. The fluid removed contained only a small amount of albumen. The microscopic examination showed the presence of large pale cells, some of them filled with granular matter. The condition of the patient was considerably improved by the tapping. Four days after the operation the cyst was again filling rapidly, and on percussion it seemed to occupy the middle of the abdomen, its upper

margin being somewhat below the umbilicus. Dec. 22, the labia majora and lower extremities were œdematous and the tumor was as large as before tapping. Jan. 1, 1867, she suffered from a severe attack of dyspnœa during the night; at this time the area of dulness over the tumor had extended to within two inches of the ensiform cartilage, the umbilical depression was effaced, and the lumbar regions were resonant on percussion. On the following day the patient was removed to a private dwelling where abdominal section was performed. After cutting through the skin and muscular layers in the linea alba, a thin smooth and very vascular membrane protruded through the wound. Through a small puncture which was made into this membrane, a milkwhite fluid escaped. A trocar was pushed through the membrane and a large amount of the same fluid poured out. On making traction upon the membrane the umbilical depression was restored. This circumstance, as well as the difficulty which was experienced in an attempt to separate the membrane and the prolapse of the small intestine which now occurred, combined to prove that the supposed cyst wall was the parietal peritoneum. The abdominal cavity was opened and on exploration both ovaries were found normal in structure and position. The abdominal wound was closed with two rows of sutures. The fluid removed measured 27½ pints and resembled milk in its gross appearance; it coagulated spontaneously and contained in suspension the same morphological elements as the fluid removed by tapping, with the exception that in addition numerous fat globules were found. The patient died Jan. 5, the symptoms during her illness indicating diffuse peritonitis. The post-mortem examination was made by Professor Klebs. Intestines crowded upwards, the transverse colon studded with numerous white or myxomatous nodules, very much contracted, forming a curve with the concavity directed upward, being separated from the

stomach by a cyst with thin walls. The anterior wall of this cyst was made up of the lesser omentum. On opening the cyst, a large quantity of fluid escaped resembling in every particular the fluid which had been removed from the peritoneal cavity. The floor of the cyst was covered with nodules composed of grayish jelly-like masses. The principal portion of this material belonged to the pancreas. This organ had been transformed into a mass four inches in width and twelve inches in length, and was composed almost entirely of gelatinous nodules; in the centre of the mass the common duct could be identified. The mesentery contained numerous miliary nodules, and in Douglas's pouch large nodular masses were found. Left lateral ligament also contained gelatinous nodules. Remaining abdominal organs healthy. The microscopical appearances were characteristic of colloid cancer. The disease had evidently its primary origin in the pancreas.

Remarks.—Although this case does not properly come within the scope of this paper it presents, however, a few important and interesting points which have a direct bearing on the subject before us. The disease was malignant from the begining, and originated primarily either in the capsule or the parenchyma of the pancreas, and extended from there by continuity to the serous lining of the abdominal viscera. A cyst formed in the bursa omentalis anteriorly to the pancreas which had no direct communication with the peritoneal cavity. The walls of this cyst were made up of adjacent organs. The cyst, occupying the same location as true retention cysts of the pancreas, gave rise to the same signs and symptoms. After the removal of the ascitic fluid, the hydropic bursa omentalis remained and was displaced toward the left side, and thus simulated to perfection on a movable cyst. Refilling of the cyst took place more rapidly than the accumulation of fluid in the peritoneal cavity. In a diagnostic point

of view, the severity of the pain and presence of nodules which were felt through the vagina and rectum should have aroused suspicion in regard to the benign character of the tumor, as their presence invariably indicate the existence of malignant disease.

In the following case the cyst of the pancreas was mistaken for an abscess:

Case VII.—Reported by Thiersch.[1] A case of pancreatic fistula was admitted to the hospital with the following history: The patient, a stone-cutter, 38 years of age, in previous good health, was taken suddenly ill while at work. He complained of nausea and a sensation of great lassitude. A tumor developed rapidly in the region of the stomach. The rapidity with which the tumor appeared and the distinct fluctuation which could be felt, led the attending physician to diagnosticate an abscess in the anterior abdominal wall. An incision was made to evacuate the contents af the abscess, but, in place of finding pus, the operator, after cutting through the peritoneum, discovered a cystic tumor of the abdominal cavity. The wound was packed and incision of the cyst postponed until adhesions should form between the anterior surfaces of the tumor and the margins of the wound. Two and a half weeks after the incision was made, the cyst was laid open, and about three quarts of a chocolate colored fluid escaped. As the fistula which formed manifested no tendency to close, the patient sought relief in the hospital. The fistula secreted a moderate amount of a thin serous fluid. The chemical examination for pancreatic juice yielded a negative result. Thiersch dilated the fistulous tract, and ascertained by further examination that the tract was outside the parietal peritoneum and reached so far as the spinal column and the tail of the pancreas. Thiersch was of the opinion that the cyst originated from a hæmatoma of the pancreas

[1] Berliner klin. Wochenschrift, 1881.

and considered this the first case of recovery after such a lesion.

Remarks.—If the statement is correct that at the first operation the peritoneal cavity was opened and the wound packed, and that the cyst was opened after firm adhesions had taken place, it is difficult to understand how the fistulous tract could be located outside of the peritoneal cavity, as Thiersch asserts. The location and rapid growth of the tumor, as well as the conditions found at the first operation, would certainly indicate the presence of a true retention cyst complicated by hæmorrhage from the beginning or during the growth of the cyst. Although it is stated that the chemical examination of the fluid secreted yielded only a negative result, positive proof is lacking that it was not pancreatic juice, and we are entitled to the belief that the case was one of cyst of the pancreas, and the fistula a true pancreatic fistula.

In all cases reported so far, with the exception of the fatal cases, it had been impossible to learn the exact seat and nature of the cause of obstruction. For the purpose of throwing some light on this part of our subject, I will refer briefly to a few post-mortem specimens which illustrate at least one variety of obstruction.

Prof. von Recklinghausen[1] gives the result of post-mortem examination in two cases of cystic disease of the pancreas in patients who had died of diabetes mellitus. The first case was a male, 40 years of age, who had suffered from diabetes mellitus for four years. The specific gravity of the urine was 1.030, and it contained from four to five per cent. of sugar. At the necropsy it was discovered that the pyloric end of the stomach was pushed forward by a large tumor, the lower portion of which was hidden behind the transverse mesocolon, which had been the seat

[1]Auserlesene pathologische anatomisch Beobachtungen. Virchow's Archiv, vol. xxx, p. 360.

of inflammation and cicatrization. The stomach was connected with the tumor by slight adhesions, but aside of a few hæmorrhagic erosions beneath the mucous membrane, it showed no further signs of disease. Duodenum normal, ductus choledochus permeable. Portal vein passed along the lower right margin of the tumor, where it was somewhat flattened and compressed. Splenic vein slightly dilated. Between the right border of the tumor and the duodenum the head of the pancreas could be seen, presenting a healthy appearance. The common pancreatic duct was pervious at its duodenal extremity and had not suffered any alterations in the head of the gland, but in the body it approached the tumor directly, and was no longer surrounded by gland tissue, but by dense connective tissue which connected the head of the pancreas with the tumor. At the point where the duct terminated in the tumor its lumen was completely filled with a calculous concretion the size of a pea. The tumor was as large as a child's head, nearly round, and consisted of a dense sac which contained a thin, yellowish fluid. In the fluid cholesterine and fat crystals could be seen with the naked eye. On standing, it deposited a white sediment which, under the microscope, showed granular cells and *débris* of cells. The cyst wall was of uniform thickness, measuring about three mm. The sections appeared somewhat gray, at some points interspersed with a slate-color. The inner surface of the cyst on the whole was smooth, with isolated thickened patches resembling the sclerotic patches in atheromatous arteries. At some points the inner surface is somewhat elevated by thick membranes of a pearly, glistening appearance and gray color, which could be easily detached. The surface underneath these membranous patches was somewhat rough. Upon the inner and posterior wall of the cyst a groove could be distinctly traced from left to right which, at its left extremity, terminated in a canal,

the size of a crow's quill, perforating the cyst wall. On tracing this canal beyond the wall of the sac it was found to dilate, its lining being white and smooth and, at some points, being thrown into transverse folds. The tail of the pancreas, which contained this duct, was indurated and sclerosed, containing no well marked acini, but it had retained its glandular structure. The terminal blind end of the duct, much dilated, was surrounded by dense connective tissue. The length of the duct from the sac to its termination measured two inches. The right extremity of the groove terminated in a second opening, through which a probe three mm. in diameter could be passed directly into the common duct in the head of the pancreas, after passing the concretion which filled the duct. Between the tail and head of the pancreas the glandular tissue had entirely disappeared, and its space, to the extent of two and a half inches, was taken up by the posterior wall of the cyst, which rested directly against the soft tissues between it and the vertebral column. The large vessels behind the tumor were not adherent, and in nowise affected by the tumor. In his remarks on the origin of this cyst, the author expressed his belief that it was caused by dilatation of the ductus Wirsungianus from obstruction to the free outflow of the pancreatic secretion by the calculus. The lungs and intestines were the seat of extensive tubercular disease.

Remarks.—The specimen just described illustrates an important lesson in pathology, viz.: that long continued obstruction will eventually result in total destruction of the anatomical structure, and physiological function of the organ or part of organ beyond the point of obstruction. This fact has a direct practical bearing on the question of treating a cyst of the pancreas by the formation of á pancreatic fistula. The definitive closure of the fistula would be prevented if the distal portion of the gland tissue remained intact and the obstruction to its outflow

remained permanent. Clinical experience and pathological specimens, however, tend to prove that the enormous distension and pressure produced by these cysts, as well as the etiological conditions which produce them, result in almost complete destruction of the secreting structure in the immediate vicinity of the cysts, and the distal portion of the gland, which is equivalent to cessation of the secretory function of that portion of the organ.

The second specimen described by von Recklinghausen was obtained from a male, aged 26 years. who also died of diabetes. The lungs, pleura, and intestinal canal revealed the presence of tubercular lesions. The pancreas had undergone fatty degeneration so that only its head contained remnants of healthy glandular tissue. The common duct in the head of the organ was found dilated, and presented a varicose appearance. It contained a tenacious whitish fluid in which were suspended small calculous fragments composed of carbonate and phosphate of lime. In addition the duct contained two calculi, of which one measured one inch in length and three-eighths of an inch in thickness; the second, still larger in size, was one and one-third of an inch long and of the same thickness. Both of these stones presented depressions and elevations on their surfaces which corresponded to the irregularities of that portion of the duct in which they were lodged. The common duct in the body and tail of the organ was dilated, its walls much thickened. The same changes were observed in the accessory ducts which could be traced through the fatty tissue, where they were seen to terminate in white strings of connective tissue. The distal ends of the small ducts contained mucus and fine calculous concretions.

Remarks.—In this instance, the dilatation of the duct did not proceed to any great extent, on account of the fatty degeneration of the organ, which probably occurred *pari passu* with the formation of the

cause of obstruction, consequently the physiological activity of the gland was abolished, and no pancreatic juice was secreted behind the seat of impaction. The presence of the adipose tissue which preserved the shape and size of the organ is attributed by the author to a hypertrophy of the interstitial and adipose tissue rather than to a fatty degeneration of the secretory elements of the gland.

TOPOGRAPHICAL ANATOMY.

For a correct interpretation of the signs and symptoms of cysts of the pancreas, and for an accurate understanding of the relations of this organ to surrounding parts in their surgical treatment, it becomes necessary to allude briefly to the topographical anatomy of the pancreas. The pancreas is a tongue-shaped gland placed transversely in the abdomen, at a point opposite the first lumbar vertebra behind the stomach, reaching from the hilus of the spleen to the concavity of the duodenum. Its right end, termed the head, is embraced by the curvature of the duodenum, whilst its left or caudal extremity is in contact with the spleen. After opening the abdominal cavity in cadavers, it can be distinctly felt as a firm body through the walls of the stomach. The organ is made accessible and exposed to sight by cutting the ligamentum gastro-colicum transversely, and by pushing the stomach upwards and the transverse colon downwards. In the saccus epiploicus, which has now been opened, the gland is seen in front of the large vessels. It presents three surfaces for examination. The anterior surface, somewhat concave, is in contact with the stomach throughout its entire extent, but separated from it by a covering from the omental bursa which renders the surface smooth and well adapted for the free movements of the stomach. The posterior surface is separated from the spine by the vena cava, aorta, the superior mesenteric artery, and

vein, the pillars of the diaphragm, and towards the liver, the vena porta, as well as numerous lymphatic vessels and glands, all of which are firmly connected with this surface, and the spine, by connective tissue. To the left of the vertebral column it is attached in the same manner to the left suprarenal capsule, kidney, and renal vessels. The superior mesenteric artery and vein are embraced by the substance of the gland, so as sometimes to enclose these vessels in a complete canal. The inferior surface is narrow and directed toward the transverse colon, it rests at one end on the junction of the duodenum and jejunum, at the left end on the extremity of the transverse colon. The intervening middle portion of the inferior surface has a special peritoneal covering derived from the lower layer of the mesocolon. Along the posterior surface and upper border of the gland are placed the splenic artery and vein, both pursuing a tortuous course from right to left. The cœliac axis is above the pancreas. The common bile duct is in close relation to the head of the gland, passing down along its posterior surface, and is generally received into a groove or canal in its substance.

The common pancreatic duct, or canal of Wirsung, is widest near its entrance into the duodenum, where it is from one-twelfth to one-ninth of an inch in diameter. Before its termination it unites with the common bile duct in the wall of the intestine, at the junction of the second and third portions of the duodenum, between three and four inches below the pyloric orifice of the stomach. The lower extremity of the head, where it curves behind the mesenteric artery and vein, is sometimes marked off from the rest, and is then called the *lesser pancreas*, with a special duct which joins the common duct in the substance of the head of the pancreas. The pancreas receives its blood supply from the superior and inferior pancreatico-duodenal branches of the hepatic and superior mesenteric arteries. The venous return

takes place through the splenic and superior mesenteric veins. The nerves are derived from the solar plexus.

ACCESSORY PANCREAS.

The pancreas, like many other glandular organs, sometimes presents rudimentary duplicities, and it is necessary to call attention to this fact for the purpose of considering the possibility of the origin of a pancreatic cyst from one of these appendages. Rokitansky[1] mentions, as an exceedingly rare occurrence, duplicity of the pancreas and excessive development of accessory appendages. A frequent variety is represented by the head of the gland—the pancreas minus—the duct of which usually terminates in the common duct, but sometimes, as was first ascertained by Winslow, it takes an independent course and empties into the duodenum about one to one and one-half inches below the opening of the common duct. More recently, Hyrtl has called attention to an accessory pancreas consisting of a few isolated acini of the gland behind the superior mesenteric artery and vein. Klob has described an accessory pancreas distant and distinct from the normal organ, which was found between the muscular layers of the stomach, about the middle of the great curvature. On another occasion he found a similar organ in the posterior wall of the jejunum, near its upper termination. In both instances, the true glandular structure of these bodies was confirmed by microscopical examinations.

Zenker met with six instances of supernumerary pancreas. The accessory organ was invariably in the walls of the intestine, three times in the highest convolution of the jejunum, twice near the duodenum, and in the last case in the upper portion of this portion of the intestinal tract. In size the glands

[1]Nebenpancreas in der Darmwand. Virchow's Archiv, vol. xxi, p. 369.

varied from a lentil to a silver dollar. They were situated between the intestinal tunics, and presented a prominence on the serous surface. Klob found no excretory duct in his specimens. Zenker detected the terminal end upon the mucous surface of the intestinal canal in the shape of a slightly raised papilla which could be seen with the naked eye or by means of a magnifying glass. The presence of pancreatic juice in the glands was also determined. In all instances, the gland proper was found in its normal location and of natural size. All patients were adults. Like other accessory organs, the supernumerary pancreatic glands owe their origin to embryonal deposits of gland tissue. Although, as yet, no instance has been observed of cystic formation from an accessory pancreas, there is no reason why such an occurrence should not take place, for the same reasons and in the same manner as has been observed in cases of cysts from supernumerary thyroid glands.

PATHOLOGY AND MORBID ANATOMY.

Cysts in the pancreas always result from retention of the secretion, and subsequent dilatation of the secretory duct, or, in case of laceration of this structure, from extravasation of the secretion into the parenchyma of the gland and subsequent distension of its capsule. The size of the cyst is modified by the character and seat of the obstruction and its relative position to the secreting gland structure. The walls of the cyst are usually thin, from over-distension, in cases of rapidly growing cysts, or much thickened when the growth of the tumor has been slow and accompanied by chronic proliferation and induration of the connective tissue. The cyst walls in chronic cases may become cartilaginous or even ossified. The inner surface is either smooth, or it presents evidences of degeneration similar to those which occur on the internal surface of arteries in the later

stages of endarteritis. If the canal of Wirsung is obstructed at or near its proximal end, the entire duct and its branches may become dilated, presenting the appearance of varicose veins, or a more uniformly rounded cyst may form of the size of an orange, of a child's head, or even so large as to occupy the whole abdominal cavity, as in Bozeman's case. As the cyst increases in size, the gland-structure disappears by absorption in consequence of intra-cystic pressure. The same cause which constitutes the obstruction will often also lead to destruction of the parenchyma of the organ, by inducing a chronic interstitial pancreatitis which is followed by cirrhosis or fatty degeneration of the organ. Virchow[1] alludes to cysts of the pancreas under the name of ranula pancreatica, and describes two essential and distinct varieties: In the first class, the entire duct is found dilated, and resembles in appearance a rosary. In the second variety, the outlet of the excretory duct is obstructed, and behind the seat of obstruction the duct undergoes cystic dilatation. He mentions a case that came under his observation where such a cyst had attained the size of a fist.[2] He believes that cicatricial contractions or pressure of tumors upon the duct constitute the most frequent source of obstruction. Pancreatic juice in its purity is only found in small and recent cysts. Later on, in old or large cysts, various accidental products are added. Albuminoid degeneration or suppuration not unfrequently take place, or hæmorrhage may occur, so that the cyst contents assume a bright red or chocolate-colored appearance. Pepper found in such a cyst numerous crystals of hæmatoidin, while Hoppe found in another instance urea in the proportion of 0.12 per cent. as one of the constituents of the contents of the cyst. The pressure of the cyst upon

[1]Die Krankhaften Geschwuelste, vol. i, p. 276.

[2]Ueber die Leucin u. Tyrosin Abscheidung an der Leber. Virchow's Archiv, vol. viii, pp. 360, 361.

neighboring organs will result in secondary pathological conditions which will interfere with the physiological performance of the functions of other organs, thus endangering the life of the patient.

ÆTIOLOGY.

The causes which result in the formation of small cysts of the pancreas, or cysts which result from compression by tumors, which in themselves do not admit of an operation for the removal and at the same time constitute a source of danger to life, do not come within the scope of this paper. In the latter instance the cyst is simply a sequence of the primary cause, and as such it will seldom, if ever, become the sole or direct object of surgical treatment. The causes of retention in cysts amenable to operative treatment, are such which in themselves do not imperil the life of the patient. They may be classified as follows: 1. Obstruction to the outflow of the secretion from impaction of calculi in the common duct or its branches. 2. Partial or complete obliteration of a portion of the duct from cicatricial contraction. 3. Sudden or gradual obstruction of the duct without diminution of its lumen from displacements of the pancreas.

1. *Calculi.*—The impaction of the pancreatic duct at its outlet may be caused by the presence of a biliary calculus in the ductus communis choledochus, at the junction of the former with the latter. A case of this kind has been reported by Engel.[1] In such cases the obstruction gives rise to retention of the secretions from the liver, and the pancreas, and dilatation of the excretory ducts in both organs. Calculous concretions in the pancreatic ducts have been frequently observed to give rise to retention cysts. Johnston[2] has collected 35 cases, in which, upon

[1]Oestr. Med, Jahrb. vol. xxiii and xxiv, 1841.

[2]Calculous and other affections of the Pancreatic Ducts. Am. Jour. Med. Sciences, Oct., 1883.

post-mortem examinations, stony concretions were found in the pancreas. Incrustations are not as frequent as free concretions. Gendrin has described a pancreatic cyst where the normal pancreatic secretion was converted into a fatty, chalky pap. The causes which produce a concretion in the pancreatic duct are chemical changes in the secretion itself, or, an obstruction to its free exit by inflammatory changes in or around the common duct. The degree of dilatation, other things being equal, is in direct proportion to the completeness of the obstruction to the outflow of the secretion. It may be well to allude to the possibility that in some instances a pancreatic calculus may remain stationary for an indefinite period of time in the duct, giving rise to no symptoms, and only partial obstruction, until by the action of some determining cause, it is forced into a position where it effects complete mechanical obstruction to the outflow of the fluid, and a rapid increase in the size of the cyst. As an impacted biliary calculus may give rise to pancreatic obstruction, so a pancreatic calculus, when it is impacted at a point where compression of the common bile duct can take place, will produce icterus and dilatation of the gall bladder and bile ducts. Meckel has reported such a case.[1]

Among the specimens of pancreatic cysts so far examined, which were caused by concretions, none of them had attained the size of those which have been submitted to surgical treatment. As in most of these preparations the calculi did not completely fill the calibre of the duct, they caused only partial obstruction which would furnish an explanation of the slow growth and comparatively small size of the tumor. In the specimen described by Gould[2], it appears that the common duct was completely closed by two calculous concretions at its entrance into the

[1]Koreff. Diss. sistens theoreticam considerationem icteri novis quibusdam causis simul superstructam. Halle 1763.

[2]Anatomical Musum of the Boston Society. Boston, 1847, p. 174.

duodenum, and this cyst had attained considerable size, in fact, it is the largest cyst on record where it was proved that the dilatation was caused by the presence of a calculus. As in the successful operations on cysts of the pancreas it has been impossible to ascertain the exact nature of the obstruction, the possibility of retention from a calculus cannot be eliminated with certainty.

2. Cicatricial Contraction.—Cicatricial contraction is always the result of an antecedent inflammation. The cicatrix may be located in the peri-pancreatic tissue or in the substance of the gland itself. Hoppe[1] made a post-mortem examination of a patient who had been deeply jaundiced during life. The gall-bladder and bile ducts were distended with bile which contained blood; the pancreatic duct was also cylindrically dilated, and many of its branches were distended into cysts the size of a hazel-nut. The cause of retention of both secretions was found in a dense cicatrix which surrounded both ducts at their duodenal termination. Interstitial inflammation in the gland itself and subsequent cicatricial contraction is one of the most frequent causes of retention. Wyss has reported a case where the interstitial inflammation was limited to portions of the head of the pancreas, through which the common bile duct and the ductus Wirsungii passed, and which had resulted in dilatation of the latter and its branches, which again compressed the bile duct, producing in this manner intense icterus.[2] Bécourt has given a description of a similar specimen[3] which he found in the Strassbourg Pathological Museum. The patient had died of icterus. The gall bladder and bile ducts were found distended; the pancreas was converted into a dense tissue which, being cut into, presented

[1]Ueber einen abnormen Harnstoff enthaltenden pancreatischen Saft vom Menschen. Virchow's Archiv, vol. xi, p. 96.

[2]Zur Ætiologie des Stauungsicterus. Virchow's Archiv, vol. xxxvi, p. 455.

[3]Recherches sur le pancréas. Strassbourg, 1830.

a chalky deposit four to eight inches in length and of a yellowish color. The duct of Wirsung was dilated to such an extent as to form a large cyst which occupied the whole length of the pancreas, its walls being inseparable from the substance of the gland. In this case the interstitial inflammation was more extensive and the cyst was much larger. In the cases reported by Pepper and Hjett the obstruction was due to the same cause. In Curnow's case the common duct had become obliterated at its entrance into the duodenum by catarrhal inflammation. The pancreas was atrophic, and its duct was filled with numerous calculi. The pancreatic juice had become inspissated. The cystic duct of the gall bladder was impermeable, while in the common bile duct a number of small gallstones were found.[1]

I have failed to find in the literature an allusion to stricture of the duct, the result of traumatism. The pancreas is an exceedingly slender organ of loose and somewhat friable texture, and hence, although remotely located and well protected by surrounding organs, I am of the opinion that it is more frequently the seat of injury than has been generally supposed. If the stomach is empty and the abdominal muscles relaxed, a blow over the region of the pancreas may result in serious contusion or laceration of the organ without rupture of its envelope. Again, a well directed blow over either extremity of the gland may cause a laceration of its tissues by traction force, the organ being securely fixed in its place by firm connective tissue attachments. The clinical history of several cases of rapidly growing cysts tends to prove that obstruction occurred in this manner. If the duct escapes injury, the cicatricial contraction attending and following the reparative process in the lacerated gland tissue will gradually compress the duct, or by lateral traction change its direction and

[1]Trans. of the Path. Society of London, vol. xxiv.

thus impede the outflow of the secretion. If the duct is ruptured at the time of injury its lumen may become completely filled by a thrombus which renders it impermeable, giving rise to retention and extravasation of the secretion primarily and secondarily, to definitive occlusion of the duct by cicatricial contraction at the point of injury. I am quite convinced that in the case which I have reported the retention was the direct result of traumatic stricture of the common duct. Although this view is not supported by evidence from post-mortem examinations, it is confirmed by analogous production of cysts in other locations. It is evident that this class of cases would furnish the most favorable conditions for successful surgical treatment.

3. Obstruction from Displacement of the Pancreas. As the pancreas is retained in its normal transverse position by the surrounding organs and connective tissue attachments, a relative change of position of portions of the gland would result in a bending of the organ and obstruction in the duct at the point of flexion. This condition was the cause of retention in a case related by Engel,[1] who found in a woman 60 years of age that the tail of the pancreas formed a right angle upwards with the principal duct of the gland. A dislocation of this kind can occur in one of the following ways:

1. Abnormal relaxation of the connective tissue attachments of the gland permitting a portion of the organ to descend by its own weight lower in the abdominal cavity.

2. Pressure upon the gland by tumors or exudations.

3. Cicatricial contractions in the substance of the organ or peripancreatic space.

That the whole pancreas can become displaced is proven by the case reported by Dobrzycki.[2] A man

[1] Op. cit.

[2] Fall von beweglicher Bauchspeicheldrüse, Virchow u. Hirsch's Jahresb, 1878, vol. ii, p. 215

50 years of age fell from a distance of some yards. Symptoms arising after the fall similar to those of a floating kidney. By palpation the displaced organ could be located. Saline fluid was vomited, resembling pancreatic juice. In the hypogastrium a movable tumor could be felt corresponding in position and shape to the pancreas.

DIAGNOSIS.

The question of diagnosis can only be entertained in cases where the cyst has attained very considerable proportions. The most important points to be taken into consideration are the history of the case, the anatomical location of the tumor, and its relations to the surrounding organs. The cases which have been reported have occurred exclusively in adults. Sex appears to exert no determining influence. In a number of cases the clinical history alludes distinctly and forcibly to traumatism as the exciting cause. In Gussenbauer's case the beginning of the illness was traced to indiscreet eating and drinking.

In all instances of cystic tumors in the region of the pancreas, close inquiry should be made to ascertain the existence of antecedent inflammatory affections of the organ, or in its immediate vicinity. A history pointing towards the existence of a biliary or pancreatic calculi will also prove valuable in arriving at positive conclusions. Rapid growth of the tumor speaks in favor of its pancreatic origin. In Gussenbauer's, Kulenkampff's, and my own cases the tumor attained an enormous size within a few weeks. Considering the relations of these cysts to important surrounding organs, it is remarkable that they give rise to no serious symptoms aside from the pressure they exert upon adjacent organs. Pain is not a constant symptom, and when it is present it is due more to the causes which produce the cyst than the cyst itself. In this respect cysts of the pancreas form a

counterpart to malignant disease when it affects this or neighboring organs. Emaciation is due either to coëxisting affection of the gland, or the impairment of function of important organs by pressure of the cyst. It is never as marked in these cases as in malignant disease. The supervention of fatty stools would point towards the existence of some coëxisting serious lesion of the pancreas rather than the existence of a simple cyst of the organ. This symptom was not found present, or it was overlooked, in all cases which have been operated upon. Of twenty-eight cases of stearrhœa, which were compiled by Ancelet,[1] sixteen were examined post-mortem. In five of these there was occlusion of the ductus choledochus and pancreaticus; in three, occlusion of the pancreatic duct alone; in one, inflammation of the pancreas and some of the adjacent organs. In the remaining cases disease of the liver and the bowels, or only marasmus, was found. In thirteen cases of pancreatic calculi collected by Johnston,[2] only in three were fatty stools observed; in six cases, diarrhœa; in four cases, melaena; and constipation in the remaining six. The presence of fat in the stools is a symptom of great importance in the recognition of pancreatic disease, but that it is not of absolute diagnostic significance is proved by the well-known fact that the same condition will follow upon the obstruction of the biliary passages and affections which impair the functional activity of other organs of digestion.

Obstruction of the principal duct impairs digestion more than when its distal extremity or one of the accessary ducts is involved. The actual illness of the patient is usually preceded, for a variable length of time, by more or less marked symptoms of gastro-intestinal derangement, accompanied in some instances by pain in the region of the pancreas.

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[1] Etudes sur les maladies du pancréas. Paris, 1867.
[2] Op. cit.

A peculiar color of the skin, which is believed by some to be characteristic of pancreatic disease, must be mentioned, as it was observed in several cases of calculous affection and cysts of the pancreas. The appearance presented by these patients is variably described as being unhealthy, pale-yellow, dirty, or earthy. The intimate relations of the cyst to the cœliac plexus will explain the cause of cœliac neuralgia which is met with in some of these cases. Atrophy of the cœliac plexus, from long continued pressure, may give rise to mellituria for the same reason that Klebs has affirmed, that partial extirpation or atrophy of the cœliac plexus will cause the presence of sugar in the urine. Diverse diseases of the pancreas have also been known to produce diabetes mellitus. Cases of this kind have been reported by Cowley (1788), Bright, Elliotson, Frerichs, Fles, Hartsen, Silver, Recklinghausen, Munk, Seegen, and Friedreich. Klebs demonstrated by his experiments that complete extirpation of the pancreas or ligature of its duct invariably gave negative results, as far as diabetes was concerned, and this may account for the fact that no sugar was found in the urine of the cases reported in this paper. The cyst, when examined early, before it has attained considerable size, is always found in the region normally occupied by the pancreas. The exact location, however, is not always uniform, as it will depend upon the portion of the pancreas from which the cyst has taken its primary origin. It may be situated below the right lobe of the liver, as in Kulenkampff's case; in the epigastric region, as in Gussenbauer's case; or in the left hypochondrium, as noted in my case. When the tumor has attained a large size, or occupies the whole abdominal cavity, it will be difficult, and in the latter instance impossible, to determine by any known means its primary origin. In such cases it is of paramount importance to study its relations to adjacent organs. The tumor is always and invariably situated

in the bursa omentalis, and from this point, as it increases in size, it encroaches upon the space occupied by adjacent organs. The stomach is pushed forward in all cases, and later to the right. The transverse colon is displaced downwards, the spleen to the left, and the diaphragm and contents of the chest upwards. The cyst being in direct contact with the diaphragm, it usually ascends and descends with the respiratory movements of the chest.

In doubtful cases it will become necessary to inflate the stomach and colon, with a view to ascertain their relative position to the cyst. If the patient is a female, and the tumor occupies the entire abdominal cavity, it will simulate cystic disease of the ovary so closely that a differential diagnosis between the two is impossible. The cases reported by Luecke, Bozeman, and Rokitansky furnish adequate proof of the correctness of this statement. The proximity of the abdominal aorta is such that the impulse of the artery is imparted to the tumor, which, however, pulsates only in one direction—away from the artery—a fact which will always distinguish it from an aneurism. Unless the cyst is exceedingly tense a sense of fluctuation is always imparted by palpation. Palpation is rendered difficult on account of the deep location of the pancreas and the rigidity of the recti abdominis muscles. The normal pancreas can only be felt under certain favorable conditions. Concerning this point Sir William Jenner says: "By deeply depressing the abdominal walls about a hand's breadth below the umbilicus, by then rolling the subjacent parts under the hand (the stomach and colon must be empty), it might be possible to detect it in an individual who is thin, and whose tissues are lax." In case the examination is rendered difficult on account of great rigidity of the abdominal muscles, this obstacle can be overcome by examining the patient while under the influence of an anæsthetic. An exploratory puncture with a fine and perfectly aseptic

needle of a hypodermic syringe will not only add material diagnostic information by revealing the character of the cyst contents, but the procedure will also settle the question as to the existence or absence of adhesions between the cyst walls and the parietal peritoneum. In the differential diagnosis the following affections will come up for consideration: 1. Malignant disease of the pancreas or adjacent organs. 2. Aneurism. 3. Echinococcus of liver, spleen, or peritoneum. 4. Affections of retroperitoneal lymphatic glands. 5. Hydro- or pyo-nephrosis. 6. Cystic disease of supra-renal capsule. 7. Circumscribed peritonitis with exudation. 8. Ascites. 9. Cystic disease of ovary.

1. *Malignant Disease of the Pancreas or Adjacent Organs.*—Carcinoma, or sarcoma of the pancreas or adjacent organs, as in every other locality, always manifest their presence by their most characteristic clinical features—pain, emaciation, and progressive local and general infection. The age of the patient and the previous history of the case will also furnish important diagnostic information. Large pancreatic cysts are unilocular, while, on the other hand, if a malignant tumor has undergone cystic degeneration, usually more than one cyst can be recognized. Hardness and irregularity of surface speak in favor of malignancy; on the other hand, smoothness and a regular round or oval contour of the tumor are constant features of a pancreatic cyst. The time which has elapsed since the beginning of the illness is also of importance. A rapidly growing pancreatic cyst will assume a size in two or three weeks which even for a malignant tumor would require as many months.

2. *Aneurism.*—An aneurism of the abdominal aorta can be distinguished from a pulsating pancreatic cyst by its pulsations being felt in all directions, and by the presence of a bruit. As a further test, the suggestion of Dr. Pepper may be resorted to, which con-

sists in placing the patient in the genu-pectoral position, when the tumor, by gravitation, will leave the aorta and all pulsation will cease. Steady pressure will diminish the volume of an aneurism, but will have no effect on a cyst of the pancreas.

3. Echinococcus Cysts.—Echinococcus cysts of the liver, spleen, or peritoneum could be easily mistaken for a cyst of the pancreas. The peculiar fremitus sometimes felt on palpating an echinococcus cyst should always be sought for. Multiplicity of cysts would decide in favor of something else than a pancreatic cyst. The presence of hooklets in the aspirated fluid would furnish positive evidence in favor of the presence of an echinococcus cyst, while their absence would not exclude the possibility of the tumor being a sterile echinococcus cyst. As the surgical treatment in both instances would be identical, it is sufficient for practical purposes to narrow the diagnosis down to a probable existence of either affection.

4. Affections of retroperitoneal lymphatic glands.—Neoplasms, inflammation, suppuration, or hypertrophy of the retroperitoneal glands behind the pancreas might simulate a pancreatic cyst, and as a wrong diagnosis in such an event might prove disastrous to the patient, and reflect discredit upon the surgeon, every diagnostic resource should be exhausted in order to prevent such error. Enlargement of the lymphatic glands, from any cause, sufficient in extent to simulate a pancreatic cyst, would almost of necessity give rise to serious constitutional disturbances and extension of the disease to neighboring organs.

5. Hydro- or Pyo-nephrosis.—In hydro- or pyonephrosis, the early clinical history will present a group of symptoms pointing toward some lesion in the pelvis of the kidney, or ureter. A chemical and microscopical examination of the urine may furnish conclusive evidence of the existence of some renal affection which has produced the obstruction. Tumors

of the kidney usually occupy a lower place and are more laterally located than tumors originating in the pancreas. In case of a pancreatic cyst, the lumbar region below the kidney is tympanitic, which is not the case in hydro- or pyo-nephrosis. In case of doubt, an exploratory puncture may enable us to arrive at a positive conclusion.

6. Cystic disease of the suprarenal capsule.—The suprarenal capsule may be the seat of cystic degeneration, and simulate a cyst of the pancreas so closely that a differential diagnosis is impossible. In Gussenbauer's case, the diagnosis remained doubtful between a cyst of the pancreas and a cyst of the suprarenal capsule. The bronzed skin so frequently observed in diseases of the suprarenal capsule has been also seen in affections of the pancreas. As the operative treatment in either case would be the same, it is not essential for practical purposes to make a positive diagnostic distinction between the two.

7. Circumscribed peritonitis with exudation.—Primary peritonitis, with a circumscribed exudation in the region of the pancreas, would reveal a history pointing toward an inflammatory affection accompanied by the usual symptoms attending inflammation of this membrane. Fever, pain, and tenderness are symptoms which are either foreign to the history of cysts of the pancreas, or, when present, they are less intense than in peritoneal inflammations. In peritonitis, the exudation would be necessarily in the peritoneal cavity, while pancreatic cysts always occupy the omental bursa.

8. Ascites.—The question of diagnosis between a cyst of the pancreas and ascites can only arise in case the whole abdominal cavity is distended by the tumor or effusion. The causes which produce ascites must be considered separately and individually, as they are usually of such a character as to exclude a suspicion of pancreatic disease, a satisfactory diagnosis can be reached without an exploratory

puncture; but, if any doubt remains, this harmless procedure will furnish the requsite information.

9. Cystic disease of ovary.—From the cases reported we have gleaned that, in at least three cases, large cysts of the pancreas were mistaken for cystic disease of the ovary by surgeons of prominence and ability who made thorough and repeated examinations. It is not difficult to conceive that in case the tumor has assumed such dimensions as to fill the entire abdominal cavity, it would be impossible to differentiate between a cyst of the pancreas and the ovary, even by a most scrutinizing examination. The physical signs presented by either resemble each other so closely that they cannot be relied upon in discriminating one from the other. The early history of the case, if it can be obtained from a reliable source, is of more diagnostic value. In pancreatic cysts, the early symptoms are usually referred to disturbance of the digestive functions, and the patient has been aware of the presence of a tumor in the upper portion of the abdominal cavity. An ovarian tumor necessarily begins in the opposite portion of the abdominal cavity, and gives rise to pelvic distress and disturbances of the menstrual function. As the surgical treatment in both instances would be the same, it is practically not essential to make a positive distinction between the two before an exploratory incision will reveal the true nature and origin of the cyst. In recapitulation it may be stated that a positive diagnosis has so far not been made in a single instance, and that for all practical purposes it is only essential to make a probable diagnosis between a pancreatic cyst, or some other kind of a cyst, which would call for the same kind of surgical treatment. In very obscure cases, an exploratory incision, under antiseptic precautions, for diagnostic purposes, is a justifiable procedure.

PROGNOSIS.

Physiologists are agreed in assigning to the pancreas a most important function in the digestion of organic food. We know that by a special ferment it assists in the transformation of starch into dextrine and sugar, and in the digestion of albumens and fat. We should naturally expect that in diseases of this organ the digestion of these substances would be impaired in proportion to the amount of gland tissue destroyed. On the other hand, we have abundant evidence to show that even total disorganization or destruction of the pancreas is not incompatible with normal digestion and perfect health. It would seem to appear that in the absence of the pancreatic secretion other organs assume a vicarious action, and digestion proceeds unimpaired. It is also important to remember that even a large cyst of the pancreas does not necessarily result in extensive destruction of the gland, and that the remaining gland tissue continues to secrete and discharge a sufficient amount of pancreatic juice. In Bozeman's case, the cyst occupied the entire abdominal cavity, and yet, at the operation, the greater portion of the gland was found healthy in structure. The integrity of the structure and function of the gland depends less on the pressure of the cyst than the causes which were concerned in its production. The dangers arising from the cyst itself consist in: 1. Its interference with the functions of other abdominal organs by pressure. 2. Rupture of cyst and escape of its contents into adjacent hollow organs or peritoneal cavity. Compression of the stomach and interference with its normal peristaltic action is a constant occurrence when the cyst has developed to any considerable size. When such is the case, vomiting soon after meals takes place, as was noted in a number of cases which have been reported. When the cyst is of very large size most all of the abdominal organs suffer by compres-

sion, and both digestion and absorption are impaired by mechanical pressure. The diaphragm being at the same time pushed upwards, the heart and lungs are displaced in the same direction, and embarrassment of circulation and respiration follows as a necessary sequence. Like any other benign abdominal tumor, the cyst proves dangerous to life by interfering mechanically with the functions of more essential and important organs. The second source of danger is rupture of the cyst and escape of its contents into adjacent organs, an accident which may be followed by immediate death from hæmorrhage, or the life of the patient is placed in jeopardy by suppurative inflammation in the interior of the cyst, or peritonitis in case the contents have escaped into the peritoneal cavity. In Pepper's case, the immediate cause of death was hæmorrhage consequent upon rupture of the cyst into the stomach.[1] At the post-mortem examination a large quantity of blood was found in the stomach and intestine, which had entered through an opening about one-half inch in diameter, close to the proximal termination of the ductus communis. A probe passed through this opening directly entered a cyst in the head of the pancreas. A communication with any portion of the gastro-intestinal tract would almost of necessity lead to infection and suppurative inflammation in the interior of the cyst, which, under unfavorable circumstances, might lead to a fatal termination from septicæmia or extension of inflammation to adjacent organs. The prognosis may be said to depend: 1. On the nature and cause of obstruction. 2. Size of cyst. 3. The absence or presence of complications.

TREATMENT.

In the treatment of a pancreatic cyst, the indications are the same as in the treatment of any other

[1] Amer. Journ. Med. Sciences. 1871, p. 159.

kind of cysts, viz.: 1. Extirpation of the cyst. 2. Evacuation of its contents and obliteration of the cyst.

Extirpation was attempted in Bozeman's and Rokitansky's cases; in the former instance with complete success, in the latter the operation was not completed, and the patient died a few days afterwards, of septic peritonitis. It is proper to state that in both cases the operation was done for the removal of a supposed ovarian cyst and that a correct diagnosis was made in the first case during the operation, after the pedicle was traced to the pancreas and the intact portions of the gland were identified. In the second case the post-mortem examination revealed the true nature and location of the cyst. The brilliant result obtained by Dr. Bozeman is well calculated to stimulate others to follow his example. Extirpation of the cyst would guard most effectually against the formation of a permanent pancreatic fistula, but, on account of the deep location of the pancreas, shortness or absence of a pedicle, and the many obstacles thrown in the way of the operator by adjacent organs, the procedure becomes one surrounded by innumerable difficulties, and in the present state of our science, of doubtful propriety. Simple evacuation of the cyst contents by means of the aspirator, offers two principal objections against its adoption in the treatment of cysts of the pancreas. 1. Escape of cyst contents into the peritoneal cavity. 2. Re-accumulation of secretion.

Reasoning from analogy, we should naturally expect that when pancreatic juice is brought in contact with the peritoneum, it would produce a destructive effect upon it by its digestive properties, or, it might be even followed by diffuse peritonitis. In opposition to this assumption it is affirmed that in experiments on the pancreas it happens quite frequently, that pancreatic juice escapes into the abdominal cavity from the canula introduced into the pancreatic duct, without any bad results on the animals. Con-

cerning this point Heidenhain[1] says: "The animals do not suffer from this circumstance as the duct is regenerated in spite of the wounded surface being bathed in the secretion. Nevertheless it is difficult to explain this. Why do not the wounded and suppurating tissues undergo digestion by the pancreatic juice? The efficacy of the albumin ferment is destroyed in some way I presume, probably by being changed into zymogen, the living tissues having the same effect on the juice as Podolinski observed by treating the pancreatic juice with pulverized zinc or yeast ferment. Although small quantities of pancreatic juice may escape into the peritoneal cavity of an animal without any serious consequences, we have no evidence to show that the peritoneal cavity in man is possessed of the same immunity against such accident, and it would not be prudent to expose a patient to such risk until more light is thrown on this subject by further observation and experiment. At the same time we must not forget that pure pancreatic juice is only found in small cysts, as the contents of large cysts have undergone various transformations, and are mixed with different accidental products, which might prove an additional source of danger in producing peritonitis. In all of the cysts where a pancreatic fistula was established, the artificial opening continued to discharge the secretion for a variable period of time, and in two cases the discharge had not ceased at the time the report was made, and hence re-accumulation would have been inevitable, in case the fluid had been removed by aspiration. For these reasons, the treatment by aspiration should be limited to cysts of moderate size, and where adhesions have formed between the cyst and the anterior walls of the abdomen. In cases presenting these favorable conditions, aspiration deserves a trial, and may be repeated as often as required, or until symptoms

[1]Archiv. f. d. gesammte Physiologie, vol. xiv p. 466.

arise, which call for more radical measures. The needle should always be thoroughly disinfected by passing it through the flame of a spirit lamp, and by dipping it in a five per cent. solution of carbolic acid. The puncture is made obliquely, so as to prevent the formation of a fistulous opening. The fluid should be withdrawn slowly and the cyst emptied as completely as possible.

After the operation gentle pressure should be made over the cyst, by applying a compress and elastic bandage. The safest, and at the same time the most efficient treatment, consists in establishing a pancreatic fistula. The operation which accomplishes this purpose most safely and in the shortest time, consists in exposing the cyst by an incision, stitching its walls to the margins of the wound. The same aseptic precautions must be observed before, during, and after the operation, as in any other abdominal operation. The stomach being generally pushed forward, upward, and toward the right by the cyst, it is advisable to empty this organ completely as a preliminary measure by abstinence of food, and the use of the syphon irrigator. Except in my case the incision was always made in the linea alba. It seems to me that the incision should always be made over the most prominent part of the tumor, and as near as possible over the seat of obstruction. In following this rule, we select the place where we are most apt to find adhesions, at the same time we establish the straightest and most direct route to the primary origin of the cyst. An incision through the linea alba, or parallel with the costal arch, will afford the easiest access with a minimum risk of injury to important parts. The external incision should be at least four inches in length, while the peritoneum should only be opened to the extent of two inches for the purpose of making an exploratory examination, to be enlarged as occasion may require. If adhesions are found between the cyst and the omentum, and the

omentum and the parietal peritoneum, the cyst is punctured with an exploratory needle, and, if the diagnosis is corroborated, the operation is finished by incising and draining the cyst. If no adhesions are found between the omentum and peritoneum, the former is incised so as to expose the cyst wall, when either of the following plans may be pursued: The parietal peritoneum is stitched to the skin with catgut. The margins of the omental wound are pushed back under the abdominal walls so as to expose the cyst freely, when the wound is packed from the bottom with iodoform gauze, and an antiseptic dressing is applied and retained for six or eight days, or until adhesions have formed between the cyst and the margins of the wound which have effectually shut off the peritoneal cavity, when the cyst is incised and drained.

Suturing of the cyst wall to the margins of the wound as a preliminary operation should never be resorted to, as on account of thinness of the cyst walls there is danger of escape of fluid into the peritoneal cavity from the punctures made by the needle, an occurrence which the procedure was intended to obviate. With proper care, however, the operation can be completed at once. The cyst wall is grasped with two many-toothed forceps, and drawn forward so as to bring it in accurate and close contact with the margins of the wound, when the fluid is removed with an aspirator or trocar with the same care as in emptying an ovarian cyst. As the cyst becomes empty it is pulled through the wound, which obviates any further danger of escape of fluid into the peritoneal cavity. When the cyst is nearly empty it is freely incised and sutured to the peritoneal lining of the abdominal wound. The drainage tube should be fully three-quarters of an inch in diameter, and must reach from the bottom of the cyst to the surface of the wound. After emptying the cyst completely by compression, and placing the patient on

his side, a large Lister dressing is applied for the purpose of guarding against infection, and to absorb the secretions. Frequent change of dressing may be required on account of copious escape of pancreatic secretion. Past experience would dictate the advisability of protecting the skin against the digestive action of the pancreatic juice by applying freely carbolated oil. The antiseptic dressings should not be abandoned until the peritoneal cavity has become completely closed by firm adhesions, and the size of the cyst has been reduced to a fistulous tract. The drainage tube is shortened from time to time, as the depth of the fistulous opening is diminished by obliteration of the cyst from the bottom of the tract. The speedy obliteration of the cyst will depend on the continuance, abatement, or removal of the obstructing cause, or the condition of the gland tissue distal to the seat of obstruction. If the stricture in the common duct of the pancreas is complete and of a permanent character, the obstruction will continue, and, if healthy gland tissue remains on the distal side, the fistula will continue to discharge pancreatic juice. If the inflammation which caused the obliteration of the duct subsides, and the passage again becomes permeable, the natural outlet will be again established and the artificial duct will become obliterated. If an impacted calculus has caused the retention, and the fistula continues to discharge, a careful examination should be made to detect the calculus, and, if found, an effort should be made to remove it through the fistulous opening. If the obstruction has become permanent and the gland tissue on the distal side has become destroyed, either by the cause or causes which produced the obstruction, or by the intra-cystic pressure, that portion of the organ has been deprived of its functional capacity, and as no pancreatic juice is secreted, definitive obliteration of the cyst and permanent closure of the fistulous tract will take place in a comparatively short time.

In recapitulation, I believe I am justified in submitting for your further consideration and discussion the following conclusions:

1. Cysts of the pancreas are true retention cysts.

2. Cicatricial contraction or obliteration of the common duct or its branches, and impacted calculi, are the most frequent causes of cysts of the pancreas.

3. A positive diagnosis of a cyst of the pancreas is impossible; a probable diagnosis between it and some other kind of cysts amenable to the same surgical treatment, is adequate for all practical purposes.

4. The formation of a pancreatic fistula under antiseptic precautions recommends itself as the safest and most expedient operation in the treatment of Cysts of the Pancreas.